

LESSON

RVR + littleBits: Animal Imitation



Overview

What are some typical animal behaviors? Why is it important to study these behaviors? In this activity, students will become Ethologists and study the behaviors of different animals, then build an invention to mimic those behaviors! Students will create a plan for their design, build prototypes of their animals, and then test and iterate on their designs. The project concludes with a class animal share.

THE CHALLENGE

After researching an animal, use RVR to mimic how the animal moves and littleBits to mimic the animal's behaviors.



Lesson Tags

GRADE LEVEL:

Elementary, Middle (grades 3-8)

SUBJECTS:

Science, technology, engineering

DIFFICULTY:

Intermediate

DURATION:

3 x 50 minute class periods

PREREQUISITE KNOWLEDGE:

- littleBits basics
- littleBits Invention Cycle
- Sphero RVR basics



Supplies

Technology:

- [Sphero RVR](#)
- littleBits STEAM Student Set

Tools Used:

- Tape
- Scissors
- Pencil/pen

Other Materials:

- Assortment of craft and recycled materials



Description

LESSON OUTLINE:

INTRO: Introduce the lesson prompt and assess students' current knowledge. Model the activity and lead students in research on their animal of choice.

CREATE: Groups of 2-3 students brainstorm ideas and create a plan for their RVR and littleBits designs. Then, they will build their prototypes.

PLAY: Students test their prototypes.

REMIX: Students adjust and customize their designs to improve functionality.

SHARE: Students add final touches to their animals and prepare to share (either in-class or via a photo/video).

LESSON OBJECTIVES:

- Research an animal species and it's different behaviors.
- Demonstrate a basic understanding of input/output, and electric current.
- Construct a prototype of the animal, replicating it's movements with the RVR and behaviors with littleBits.
- Modify the organism to make it work more effectively.
- Share the invention with the class!

ASSESSMENT STRATEGIES:

FORMATIVE ASSESSMENT: Testing, feedback, and redesign provide excellent opportunities for formative assessment. Circulate the classroom as students work, assessing their use of the RVR and Bits, teamwork, and any other relevant skills you wish to focus on.

SUMMATIVE ASSESSMENT: Evaluate students understanding and completion of final projects during the “Share” portion of the lesson.

Documentation for this lesson can be achieved through:

- A log of their invention / exploration process - whether written in a journal/notebook or through the use of media
- A presentation or media component capturing their process (image or video)



Standards

NGSS

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-LS4-2: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.



Vocabulary

Ethology/Ethologist
Mimic

Behavior
Instinct

Species
Interact



Resources

SUPPORTING LINKS

[Sphero RVR + littleBits Animal Imitation](#)

TIPS & TRICKS

Tip #1: Keep an eye on the clock, and where students are at in their Invention Logs. Some students will want to spend too much time in the Create stage, and some students will try to speed through it.

PACING (3 x 50 minute class periods)

Day 1

Prep + Setup
Intro (30 mins)
Create (15 mins)
Close (5 mins)

Day 2

Prep + Setup
Intro (5 mins)
Create (30 mins)
Play (10 mins)
Close (5 mins)

Day 3

Prep + Setup
Remix (10 mins)
Share (35 mins)
Close (5 mins)

Instructional Steps



Step 1: SETUP

DURATION: 15 minutes prior to class

This lesson can be done individually or in small groups (2-3 students).

Each group will need one Sphero RVR and one littleBits STEAM Student Set. Additionally, this activity will require students to research different animals, so they will need sources for this research as well as a means of recording information found. Set up a central location in the classroom for assorted materials and tools.

NOTES

- You should use a classroom timer or [digital timer](#) to help keep students on track.
- Optional devices for documentation: point and shoot cameras, cell phones, computer/tablet cameras, voice recorder.



Step 2: INTRODUCE

DURATION: Day 1: 30 minutes, Day 2: 5 minutes, Day 3: 5 minutes

Day 1

Depending on students' prior knowledge, you may need to start with teaching or reteaching students about the importance of studying animals and their behaviors. Show part or all of [this video](#) as a refresher.

Ask: What is ethology? What does an ethologist study? Elicit a discussion on the role of an ethologist.

Discuss: Allow for students to share their ideas, then discuss how an ethologist is a scientist that studies animal behavior in their natural surroundings. Guide students to understand that these people also work as zoologists to study animals in captivity (like in a zoo or aquarium) and try to understand why animals behave the way they do. They make observations, or ethograms, and use scientific inquiry to explain how certain behaviors animals adapt to their environment, reproduce, communicate, find food etc.

Ask: Why is it important to study animal behavior?

Discuss: Allow for students to share their thinking, prompting with concepts from the video if necessary. Explain that research into animal behavior helps us better understand how to best manage and protect these animals!

ANIMAL IMITATION

Now, ask students to think about the last time they visited a zoo or aquarium. What animal would they want to learn more about? Tell students to pick which animal they will want to research and work with for the remainder of the activity. Then, guide students to begin the research process.

Research: Once students have decided on their animals, have them begin researching to learn more about them. They should record their findings in a journal or notebook. Guide students to consider the following points while they research:

1. Are there behaviors that are unique to that animal?
2. How do they interact with other animals of the same species? Other species?
3. Where does the animal live? How do they interact with their natural surroundings?
4. What movements do they make?

***Tip:** To provide some assistance to students, have them focus their research to be about a singular behavior (like hunting prey) and define it in writing so it can be translated to a coding program that tells the story. Example: The animal I researched was the lion. Lions live in a pride and hunt as a group, with the lioness leading the chase. A weak animal, like a baby zebra, will be targeted as prey. The lioness crouches and moves slowly towards the target...and then takes chase at a fast speed once she makes her move. She may travel in a seemingly random fashion to chase her prey, until the zebra tires and the lions are able to pounce.*

Introduce the Challenge

Explain that students will combine their RVR and littleBits to create their animal of choice! They will program their RVR to move like their animal, then use littleBits and the littleBits Invention Cycle to recreate the animals behaviors. The activity will be broken up into the following steps.

CREATE: Program the RVR to mimic the animals movements, then use littleBits to model the animals behaviors.

PLAY: Test your invention for modifications. What worked, what didn't work? It's 100% OK if there are issues - that's how inventions are built!

REMIX: Use this time to make changes to your inventions.

SHARE: Share their inventions in a presentation (or through video/photos posted online).

Then, walk through the learning sequence, and the learning targets. Finally, divide the class into groups of 2-3 and have them set up their workstations, brainstorm an animal of choice and begin researching!

Day 2-3

Briefly remind students of expectations and where they should be in the Invention Cycle.



Step 3: CREATE

DURATION: Day 1: 15 minutes, Day 2: 30 minutes

Day 1

Program RVR

After completing their research, it's time for students to program the RVR to move like their animal! Guide them to think about different movements their animal makes:

1. Does it glide, slither, jump, run, walk, etc.?
2. Is it fast, medium, slow, etc.?
3. Are movements in straight lines, curves, random, etc.?

Students should brainstorm how they can recreate these movements with their RVR using the RVR program. Here are a few suggestions for movements:

- **Roll Block:** ideal for driving in straight, angular lines.
- **Spin:** great for slow spinning of RVR.
- **Raw Motor:** set left motor to 255 and right motor to -255 and it spins really fast!
- **Speed, spin, & Stop:** great for circular rolling or curved lines.

NOTE:

- Students will have time during the next lesson to complete their RVR program. However, by the end of this session they should have a good idea of how they will recreate their animals movements, so they can remain on track to complete their project.
- For extra help, check out the [getting started activities for RVR on Sphero Edu](#).

Day 2

Program RVR

Students should complete their RVR programs during the first half of this lesson. Guide students to review their work from the first session and move forward to complete their RVR animal.

Build Your Animal Behaviors with Bits

Using littleBits, students will transform their RVR into the animal they researched by building circuits to mimic one of the animal's behaviors. Referring to their research, students should pick a behavior to demonstrate and create a list of features that will help their animal perform that behavior. Guide students to consider the following:

1. How will they use Bits to showcase the behavior?
 - a. Consider how lights, sound, sensors and/or motion Bits can be integrated into their project in order for them to achieve success.
2. How will they build and attach their Bits to the RVR?
 - a. What other materials will they need to combine their RVR with their Bits?

3. Are there ways to use littleBits to demonstrate environmental interactions?
 - a. Could they create a littleBits circuit external to the RVR to complete this project?
Encourage students to get creative!

Students should draw a prototype of their creature, labeling how their Bits will bring their animals to life. Tell them they shouldn't worry about perfection! A quickly drawn prototype that shows an understanding of the animal's form and function is much better than a beautiful sketch of a creature that won't work.

To help students, guide conversation and invention cycle around how form follows function. For example, if you're a lion, in order to be a successful hunter you need sharp eyesight, a good sense of smell, a sleek coat, a long tail for balance and muscular body to outrun you're fast and large prey. This will be a good transition for thinking about how littleBits could bring these features to life.

Then, it's time to build! Students should build their circuits and integrate it with their RVR to complete their animal.

NOTES:

- If time permits, encourage students to create some features of their animals' environment!
- Delegate! Recommend to students that they should divide the work among group members. For example, one student works as the record keeper, one works as a timekeeper, one on the RVR program, one on the Bit behaviors etc.
- For younger students, having a limited supply of materials can be helpful constraint, especially if they are building both the body of a creature and its environment.



Step 4: PLAY

DURATION: Day 2: 10 minutes

Have students take their design for a test-drive. Does their animal work like they thought it would? Were they able to successfully integrate their Bits with their RVR? What could be better? Students should take this time to identify aspects of their project they can improve upon.

NOTES:

- If time allows, have students share their creation with another group and collect feedback on what could be improved.
- Remind students to focus on the successes of their inventions during this time as well! While this time is meant for students to identify aspects that can be improved with their projects, they should also take some time to revel in their awesome animal inventions!



Step 5: REMIX

DURATION: Day 3: 10 minutes

Students should use this time during the beginning of the last session to make any improvements and changes to their animals. What will they change to improve their animals? Do they need to remix the animal's RVR movement to better demonstrate it's form and function or Bits to better demonstrate behavior? Guide them to implement changes and make finishing touches to be ready to share!

NOTES

- Keep your eyes peeled for any groups going into meltdown mode thinking "Our animal is terrible! Tear it apart!" If a group is disappointed with how their invention is going, celebrate their efforts and emphasize failing forward - e.g. learning from mistakes.



Step 6: SHARE

DURATION: Day 3: 35 minutes

Host an Animal Showcase

Time to turn the class into a zoo! Have students set up their animals take turns demonstrating their work.

NOTES

- Be crystal clear with *what* students should be showing off - both their animals and the *process* they went through to create it. What went well? What didn't? Both are super-important!



Step 7: CLOSE

DURATION: Day 1-3: 5 minutes per class

At the end of each class, have students return their RVR, Bits and any other materials to their designated areas.

Students should take apart their inventions and put away the Bits according to the diagram [here](#) and on the [back of the Invention Guide](#). Students should clean up their workspace and return any usable materials/tools.



Step 8: EXTENSIONS

Level Up with Functions

Teach students about functions and how they can be used to enhance their projects! Explain that functions are groups of blocks that can be “called,” or reused, over and over in a program. They can be thought of as programs within a program.

Ask: Why do programmers use them?

Explain: Guide students in understanding that functions save programmers time. Instead of having to add the same sequence of blocks over and over again, programmers can create a function once and then call the function whenever they need that sequence.

Students can take their Ethology further by creating several functions for different movements and behaviors their animal would complete throughout a day or night. Lead an extension activity that includes the following:

- Create a function for each unique movement type or behavior
- Create a “day in the life” program that calls the different behavior functions in the order they would happen and in which situations they would happen.